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Developing autoplay media based mathematics teaching materials for elementary school

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Abstract. This study aims to develop and create autoplay learning media based teaching materials on mathematics learning for elementary schools which meet the criteria of valid, practical, and effective. This study adopts Research and Development (R&D) through the development model of ADDIE (Analyze, Design, Development, Implementation, and Evaluation). Data collection techniques applied in this study are questionnaires and tests. Besides, the results of the research were analyzed through questionnaire analysis, t test, and n-gain test. The results of this study indicate that the development of instructional materials based on autoplay learning media meets the criteria of valid, practical and effective, where the average validation results by 3 validators are 90.67; students' response on the use of instructional media-based teaching materials is 85% which is responded positively; learning outcomes of the experimental class was better than the control class; and there was a high increase in the experimental class between pretest and posttest of 0.85.

1. Introduction

Mathematics is one of the lessons that must be taught at elementary school level. This is because mathematics can shape students to think logically and systematically[1]. It is expected that by studying mathematics, students are able to connect and understand one of mathematical concept with other mathematical concepts to solve problems in everyday life [2]. Based on the results of observations conducted by researchers at Surya Buana Islamic Elementary School of Malang, it was found that the teaching materials used by the teacher in the learning process were still very simple, namely using only thematic books prepared by the government. Teachers have not yet developed interesting and innovative teaching materials, so that student learning outcomes in mathematics material are still low. This is evidenced by the achievement of students' scores, which are mostly still under the Minimum Score Criterion set by the school which is 70. From the 24 fifth grade students, only 8 students around 33.3% achieved above the minimum score criterion. The remaining students or around 66.6% have not yet reached the minimum score criterion. In his research Wandani & Nasution (2017) [3], Wijaya & Rakhmawati (2015) [4], Nu'aimah & Kholis (2016) [5] also revealed that most teachers have not



developed interesting and innovative teaching materials needed by students in the learning process. Fakhruddin (2015) in his research stated that one of the factors that led to students' understanding of the concept of the subject matter was that the teacher had not used interactive media in learning activities [6]. Wulandari, Dewi & Akhlis (2013) [7], Suniati, Sadia & Suhandana (2013) [8], Utami & Mampouw (2018) [9] in their research also revealed that learning that does not use interactive multimedia has an impact on students' poor understanding of the subject matter.

For that reason, one alternative that can be used to improve students' understanding of concepts in mathematics learning is to develop teaching materials based on autoplay learning media. Autoplay learning media is one of the interactive multimedia-based learning. Autoplay Media is a software for creating multimedia by integrating various types of media such as images, sound, video, text and flash into the presentation that is made [10]. Interactive learning media is a two-way or communicative learning media. Interactive multimedia according to Sanaki (2009) [11] is a multimedia that is equipped with a controller that can be operated by the user so that users can choose what they want for the next process. According to research conducted by Hayumuti, Susilo & Manahal (2016) [12], they revealed that interactive multimedia learning is able to provide a concrete picture of the concept of subject matter that must be understood by students. The results of research conducted by Rajendra & Sudana (2017) [13] revealed that learning using interactive multimedia can help students to improve concept understanding of the subject matter. Research conducted by Utami & Julianto (2013) [14], Nisa, Wati & Mahardika (2017) [15], Hanafi (2017) [16] also revealed that students' conceptual understanding of the subject matter increased after the teacher used interactive multimedia. The same conclusion was stated by Maharani (2015) [17], Novyarti, Marzal & Rohati (2014) [18] she concluded that the existence of multimedia learning is very influential on understanding of students' concepts of mathematics subject matter.

2. Methodology

This study adopts Research and Development (R & D) methods. The models used in developing Autoplay media is ADDIE (Analysis, Design, Development, Implementation and Evaluation) models. This model was chosen because the ADDIE model has excellence, namely the work procedure systematic, that is, each step always refers to the previous step that has been fixed, so that an effective product can be obtained [17]. In addition, the ADDIE model is a general learning model that is suitable for development research. The product quality developed in this study is determined by 3 criteria, namely validity, practicality, and effectiveness [19], [20].

ADDIE model has 5 stages of development, namely Analysis, Design, Development, Implementation, and Evaluation. The flow of the ADDIE model can be described as shown in Figure 1:

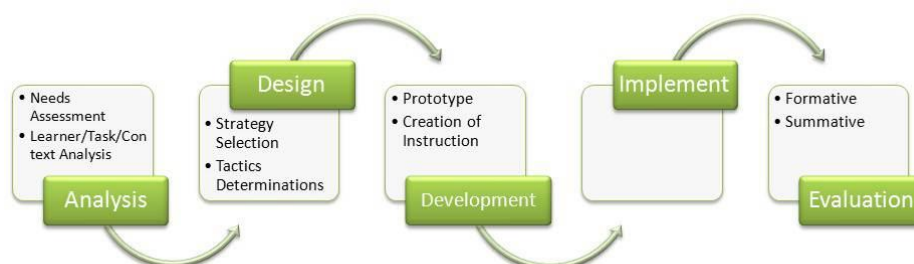


Figure 1. The Flow of ADDIE Model Development

From Figure 1, it is clear that this development model begins with the analysis phase. The analysis phase is a process of defining what students will learn, namely analyzing needs, identifying problems, and carrying out task analysis [21]. The next stage is design. Design is arranged by studying the problem, then finding solutions through identification of the needs analysis stage in the previous process. The third stage is development. At this stage researchers try to compile and design instructional materials

based on information that has been obtained from various previous stages. After the production of the Autoplay Mathematics learning media product at the 5th grade of theme 8, a validation test was conducted to the expert judgment. Validation is done to material experts, media experts, and learning experts. The fourth stage is implementation. At this stage, teaching materials are implemented in the learning process. The aim is to collect data that can be used as a basis for determining the level of practicality of the products produced. Submission of learning materials was carried out in small group trials and field trials for fifth grade students of Surya Buana Islamic Elementary School of Malang. The last stage is the evaluation phase. At this stage the researcher evaluates the products that have been developed. This is done to determine the effectiveness of the products developed, namely autoplay media. For testing this learning media is done by comparing the conditions before and after using the new system (before-after) [17]. While the target of the user trial subjects were fifth grade students of Class A as the control group and fifth grade students of class B as the experimental group at Surya Buana Islamic Elementary School of Malang.

The data collection techniques in this study were observation, questionnaires and tests. Observation techniques are used to find out the description of student activity with the application of instructional materials based on Autoplay learning media. Meanwhile, the questionnaire technique is used to collect data about the accuracy of the components of teaching materials, the accuracy of the material, the accuracy of the system, the accuracy of the design or design, the attractiveness of teaching materials based on Autoplay learning media. Furthermore, the questionnaire was analyzed to determine the feasibility of teaching materials based on Autoplay learning media as well as proposed as a guide in product revisions to produce better products. While the test technique is used to see the effect of learning outcomes on instructional materials based on Autoplay learning media, which are pretest and posttest. Furthermore, the results of the research data were analyzed using questionnaire percentage test, t test and n gain test.

3. Result and Discussion

3.1 Learning Media Validation Results







Based on the results of validation by 3 validators consisting of validators of mathematics material experts, validators of learning media experts, and practitioner validators of elementary school, it obtained the data as in table 1 below:

Table 1. Recapitulation of Learning Media Validation Results

Validator	Score	Notes
Mathematics Material Experts	91	Valid with minor revisons
Learning Media Experts	93	Valid with minor revisons
Practitioner Validators	88	Valid with minor revisons
Average	90,67	Valid with minor revisons

From table 1, it can be seen that the average score of the 3 validators is 90.67. This means that the learning media products that are developed meet valid criteria and need to be slightly revised. Validator provides suggestions for improving the learning media products, namely adding animation to the destination page, change the menu display on the evaluation page and add a timer on the evaluation page. The description of the revised learning media developed is as it follows:

Table 2. The Description of Learning Media Revision Results

Revised Points	Before Revision	After Revision
Adding an animation on the selected page so that the media become more interesting		
Changing the look of the Menu on the evaluation page to be more interesting		
Adding a timer and changing the look of evaluation page to be more simple		

3.2 The Results of the Learning Media Practicality Test

The practicality of the developed learning media was assessed based on students' responses to the learning process using autoplay media. The data of students' responses to the use of autoplay-based learning media are as it follows:

1) Test small groups

This small group test was conducted on 6 students consisting of two children representing good-ability students, two middle / medium-capable children, and two low-ability children. From the results of the small group test, it was obtained data that the total score of the students' responses to the use of autoplay media based teaching materials was 258 and a maximum score of 300. Then the percentage of student responses can be calculated as it follows:

$$\text{Percentage} = \frac{\sum x}{\sum x_i} \times 100 \%$$

$$\text{Percentage} = \frac{258}{300} \times 100 \% = 86\%$$

The calculation results above show that the percentage of students' responses to the use of autoplay media based teaching materials is 86%. The score is included in a good category, namely practical autoplay media based teaching materials used in the learning process.

2) Field trials

This field trial was carried out to 24 students of Surya Buana Islamic Elementary School of Malang. From the results of the small group test, it was obtained data that the total score of the students' responses to the use of autoplay media based teaching materials was 1030 and a maximum score of 1200. Then the percentage of student responses can be calculated as it follows:

$$\text{Percentage} = \frac{\sum x}{\sum x_i} \times 100 \%$$

$$\text{Percentage} = \frac{1030}{1200} \times 100 \% = 85\%$$

The calculation results above show that the percentage of students' responses to the use of autoplay media based teaching materials is 85%. The score is included in a good category, namely practical autoplay media based teaching materials used in the learning process.

3.3 The Effectiveness of Learning Media Test Results

Effectiveness is a criterion that shows that the media developed successfully achieve the desired goals. The effectiveness of the learning media developed is seen from the average difference between the control class learning outcomes and the experimental class and the improvement of experimental class learning outcomes before and after using instructional materials based on autoplay learning media. The effectiveness of this study refers to the results of the calculation of the t test and n gain test. The results of the calculation of the experimental class and control class learning outcomes are as follows in table 3:

Table 3. The Differences in Average of Experiment Class and Control Class

No	Aspect	Experimentt Class		Control Class	
		Pre-test	Post-test	Pre-test	Post-test
1	Average	55	87	59	84
2	completeness	8%	100%	17%	92%

Table 3 shows that the average score of the experimental class is 87 and the average score of the control class is 84. This means that the average score of the experimental class is better than the control class. To see whether the average difference is significant or not, a t- test is necessarily needed. The results of the calculation of the t test are as it follows:

Table 4. T-Test Results of Experimental Class and Control Class

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig (2-tailed)	Mean Difference	Std Error Difference	95% Confidence Interval of the Difference	
								Lower		Upper
Nilai	Equal Variances Assumed	.215	.645	1.210	46	.232	3.12500	2.58279	-2.07389-	8.32389
	Equal Variances not Assumed			1.210	45.504	.233	3.12500	2.58279	-2.07542-	8.32542

In table 4, it is known that the significance value (Sig.2-tailed) is 0.232. This score states that H_0 is rejected and H_1 is accepted. So it can be concluded that the learning outcomes (post-test) that use instructional materials based on Autoplay learning media have a significant difference. In this case the instructional material based on Autoplay learning has a better effect than conventional teaching materials on learning outcomes of Mathematics material on the theme of Ecosystems. This is evidenced by an increase in the results of learning Mathematics by using instructional materials based on Autoplay learning of Mathematics material on the Ecosystems theme the average distribution is higher than conventional teaching materials.

Furthermore, to find out whether there is an increase in the ability of students to understand the concept of the subject matter before and after using autoplay learning media, we can use the n gain test. The results of the calculation of the n gain test are as it follows:

Table 5. The results of the calculation of the n-gain test

n (number of students)	Ideal Score	n-gain maximum score	Average Score of n-gain
24	100	1	0,85

Table 5 shows that the results of the n-gain test on the comparison of the results of the pre-test and post-test obtained an average value of 0.85. This value is high. This means that the learning process using autoplay media-based learning media can improve student learning outcomes.

From the description of the above research shows that the developed autoplay learning media has fulfilled valid criteria, because the average expert validation results of 90.67 (valid) are included in the good criteria. In addition, autoplay learning media also fulfills practical criteria, because students' responses to the use of autoplay media-based teaching materials are 85%. The score is included in a good category, namely practical autoplay media-based teaching materials used in the learning process. Autoplay learning media also meet the effective criteria, because the average value of student learning outcomes is 87. This score exceeds the minimum score criterion set by the school which is 70. this was also strengthened by the results of the n-gain test which showed that there was an increase in the ability of students to understand the concept of mathematics material by using autoplay learning media of 0.85. This means that the autoplay learning media effectively enhances students' conceptual understanding of mathematics materials.

This is because the use of multimedia in the learning process has several advantages including 1) providing interactive processes; 2) providing easy feedback; and 3) giving learners to determine the topic of learning and multimedia processes to provide systematic control in the learning process [22]. In addition, according to research conducted by Smith & Woody (2000) [23], Zhang & Zhou (2003) [24], Zhang, Zhou, Briggs et al. (2006) [25], Tüzün, Yılmaz-Soylu, Karakus, et al. (2009) [26] Juanda (2011) [27] revealed that the use of multimedia in the learning process was able to increase learning motivation, learning activities, and students' learning outcomes.

4. Conclusion

Based on the results of the research described, it can be concluded that the media of autoplay learning developed has met valid criteria, because the average expert validation results of 90.67 (valid) are included in the criteria. In addition, autoplay learning media also fulfills the practical criteria, because the students' responses to the use of autoplay media based teaching materials is 85%. The score is included in a good category, namely practical autoplay media-based teaching materials used in the learning process. Autoplay learning media also meet the effective criteria, because the average score of students' learning outcomes is 87. This score exceeds the minimum score criterion set by the school which is 70. this was also strengthened by the results of the n-gain test which showed that there was an increase in the ability of students to understand the concept of mathematics materials through the use of autoplay learning media of 0.85. This means that the autoplay learning media effectively enhances students' conceptual understanding of mathematics materials.

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